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(54) Avalanche photodiode for use in harsh environments

(57) An aspect of the present invention is directed to an avalanche photodiode (APD) device for use in oil well drilling applications in harsh, down-hole environments where shock levels are near 250 gravitational acceleration (G) and/or temperatures approach or exceed 150° C. Another aspect of the present invention is directed to an APD device fabricated using SiC materials. Another aspect of the present invention is directed to an APD device fabricated using GaN materials. According to an embodiment of the present invention, an avalanche photodiode for detecting ultraviolet photons comprises a substrate (110) having a dopant of a first type; a first layer (111) having a dopant of a first type, positioned on top of the substrate; a second layer (112) having a dopant of a second type, positioned on top of the first layer; a third layer (114) having a dopant of a second type, positioned on top of the second layer; a passivation layer (116,122) for providing electrical passivation on a surface of the avalanche photodiode; a phosphorous silicate glass layer (124) for limiting mobile ion transport, positioned on top of the third layer; and a pair of metal electrodes (118,120) for providing an ohmic contact wherein a first electrode is positioned below the substrate and a second electrode is positioned above the third layer; wherein the avalanche photodiode comprises a first sidewall and a second sidewall forming a sloped mesa shape; and wherein the avalanche photodiode operates in an

environment comprising a temperature approximately equal to 150 degrees Celsius.

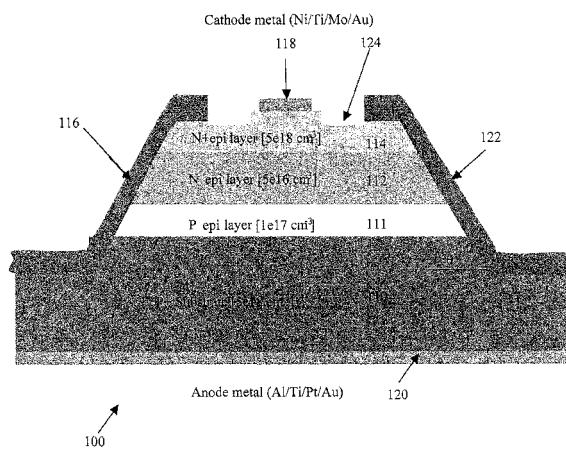


Figure 1



EUROPEAN SEARCH REPORT

Application Number
EP 03 25 7758

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
Y	JP 60 049681 A (FUJITSU LTD) 18 March 1985 (1985-03-18) * abstract * -----	1-10	INV. H01L31/107 H01L31/0232 H01L31/0352
Y	EP 0 571 142 A (GENERAL ELECTRIC) 24 November 1993 (1993-11-24) * page 3, line 56 - page 4, line 16; figure 1 *	1-10	H01L31/0312 H01L31/0304
Y	US 5 723 877 A (SUGAWA SHIGETOSHI ET AL) 3 March 1998 (1998-03-03) * figure 1 * -----	8	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01L
The present search report has been drawn up for all claims			
2	Place of search	Date of completion of the search	Examiner
	Berlin	21 November 2008	Segerberg, Tomas
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-11-2008

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
JP 60049681	A	18-03-1985	JP	1796567 C	28-10-1993	
			JP	5001629 B	08-01-1993	
EP 0571142	A	24-11-1993	JP	6037349 A	10-02-1994	
US 5723877	A	03-03-1998		NONE		